Vertebral prosthesis, in particular for cervical vertebrae.

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Abstract

1. A vertebral prosthesis comprising a plate portion (13) which is capable of being connected to two separate vertebrae, for example by scews, characterized in that, in its median zone, said plate portion (13) transversely carries in advance an artificial graft (16) made of a material suitable for promoting boney growth and having at its surface accommodation means (21) for promoting such boney growth.

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Rough Translation of Kehr Patent

The present invention generally concerns a vertebral prosthesis, and with its purpose particularly, but non-exclusively, being susceptible for application to cervical vertebrae.

For example thus, it is known that by continued natural degeneration due to aging, or to a trauma resulting from, for example, a sporting exercise or from an accident, the cervical vertebrae can be the site of a pathological situation causing one or several of these vertebral discs which separate two vertebrae, to squeeze, more or less steadily, to the rear, in the spinal canal, the spinal bone and the corresponding nerve tissue.

This has for some time been typically called a "disc hernia" or else an " osteophyte", which is necessary to be treated.

In order to do this, the surgeon must first of all intervene, by posterior access finding a path through the spinal bone.

Otherwise expressed, to obtain access to the injured disc to be treated, the surgeon has to pass across the concerned vertebral disc and ultimately eliminate it.

In most cases, and this is the case for cervical vertebrae, it is necessary to replace the vertebral disc thus eliminated by a graft.

When it is necessary to spread the vertebrae to set the graft into position, the elastic restraint developed by the vertebrae will be typically sufficient to maintain the natural position of the graft, until the re-ossification of the entirety.

But, often, notably when two separate levels are to be treated, for instance when the intervention concerns not only a single vertebral disc, but two, or when this intervention is necessary for a relatively significant trauma, it is necessary to proceed to put a prosthesis in position for the preservation of this graft.

As a result, one practice, to this day, involves a simple plate, made of steel for example, that is sized to be fitted anteriorly to the two separate vertebrae, for example by some screws.

Experience indicates that such a plate is by itself well tolerated and that it is only very rarely necessary to remove it thereafter.

To this day, the grafts implanted are natural grafts, and are usually obtained from a slice of the iliac bone of the patient to be treated.

For the peripheral area, cortical, and which is therefore hard, one such graft is made in a horseshoe shape to introduce the toughness and the necessary mechanical resistance, while for the central area, that is cancellous, it is advantageously very readily incorporated by a bony ingrowth. The vertebral level which borders it can have been slightly roughened during the intervention to stimulate the formation of bony cells and thus further the artificial osteogenesis in order to hold the entirety together.

However, the implantation, in this way, of a natural graft leads to some inconveniences, if not major, at least non-negligible.

Among the approaches, this example inflicts on the patient and in addition to this, and experience shows that most notably the muscle mass is inevitably extremely affected, the total time of recouperation for the patient is frequently found to be singularly oppressive.

In addition, the extraction of such a natural graft always is relatively involved and it inflicts on the patient the burden of a cast or of a halo over numerous weeks.

Finally, this extraction, which may never be secure, could be deficient.

The present invention has an overall object in the manner of a vertebral prosthesis capable of minimizing, or otherwise nullifying, these disadvantages.

More precisely, the invention has for an object a vertebral prosthesis of the kind including a small plate sized to be retained, for example, by some screws, between two separate vertebrae, this vertebral prosthesis being generally characterized by, in its median area, a so-called transverse plate envelope for receiving an artificial graft.

In this way, this vertebral prosthesis, can be acceptable equally well in the case where a single level is to be treated as in the case where two separate levels require an intervention, its height, and the height of the artificial graft that it contains, being predetermined, thus achieving the benefit due to the presence of a preservation plate, while eliminating the inconveniences usually associated with implanting a natural graft, such as those mentioned above.

It is certainly well known, independently with the fact that the several specific interventions of the foregoing sample are avoided, one such artificial graft being advantageously capable of leading to a considerable reduction in the time and potential burden of a cast or of a minerva halo, no major inconvenience being for example feared in case the fusion is more or less delayed.

The complete recovery of the patient is therefore advantageously more reduced and more reliable.

The features and benefits of the invention will be further evident from the description that follows with exemplary labels, with reference to schematic drawings annexed of which:

FIG. 1 is a view is perspective of a vertebral process according to the invention;

FIG. 2 is an axial cross-sectional view following the line ii-ii of FIG. 1;

FIG. 3 is a transverse cross-sectional view, following the line iii-iii of FIG. 1;

FIG. 4 is a view that, analogous to the one in view 2, illustrates, in a smaller scale, the placement of the prosthesis between two cervical vertebrae according to the invention

FIGS. 5 and 6 are transverse cross-sectional views, that, analogous to the one in FIG. 3, each respectively concerns a variant embodiment.

These Figures illustrate, with the exemplary labels, in full feature, the case where a single level is to be treated, between the vertebral levels 10 of two adjacent vertebrae 11, such as depicted in the detailed features in FIG. 4.

The vertebral prosthesis 12 implemented according to the invention includes, in a known manner, a plate 13 sized to be retained, for example by some screws 14, such as depicted, on the two instrumented vertebrae 11, and precisely on the surfaces of the vertebral bodies then.

In a preferred embodiment, the small plate 13 includes for this effect, at each of its extremities, two ears 15, each configured for the passage of one such screw 14.

These ears 15, which are provided in pairs, are collectively bent to the image of the face of the vertebral body surface 10 of a vertebra 11.

According to the invention, the plate 13 carries tranversely, by projecting outward, an artificial graft 16.

In practice, and such as depicted, this artificial graft 16 is at least partially enclosed, on at least a section of its perimeter, by two arms 17 interdependent with the plate 13 which carries them.

In one embodiment particularly as depicted in FIGS. 1–4, these arms 17 join each other, and jointly form in this way one envelope 18 which encloses the artificial graft 16 on the totality of its perimeter.

Precisely, in this specific embodiment, this envelope 18 is tubular, and having a circular cross-section, and it is integral with the plate 13, together with the arms 17 following the form of the artificial graft 16 that it encloses extending together nearly perpendicular from the middle area of the plate 13, between its ears 15, in the form of a bracket or overhung support.

In practice, the plate 13 and the envelope 18 are made of metal, for example made of stainless steel or of titanium.

The entirety can for example be obtained by suitable cuts out of a piece of tube of one such metal or alloy, or can be obtained by cutting out and suitably bending an initially flat disc to this form, the arms 17 having their ends appropriately positioned adjacent each other by bending, and eventually connected to each other, for example, by soldering.

Nevertheless it is understood that other modes of manufacturing can be acceptable.

The artificial graft 16, as for itself, is preferably in ceramic, and for example, an alumina frit (calcinated). Itself appears, indeed, that, in a bony surrounding, such a material, that is elsewhere well tolerated, exhibits a certain natural aggressiveness to provide the foundation/support.

In practice the artificial graft 16 is presented, in the preferred embodiment, in the form of a portion of cylinder, that is flush with the surface of the envelope 18 that encloses it, and of which its corresponding transverse surfaces 20 are, in the form or another, uniformly smooth, perpendicular to the longitudinal direction of the small plate 13.

Preferably, the artificial graft 16 presents, in the form of a hollow, on each of its transverse surfaces 20, some housings 21 therethrough to encourage a bony ingrowth.

In practice, and as depicted, these housings 21 extend as tubes from one to the other of the transverse surfaces 20 of the artificial graft 16.

They are advantageously constituted, when they are invaded by the bony ingrowth resulting from the desired osteogenesis, to favorably produce a linear proliferation of this bony ingrowth.

Preferably, the artificial graft 16 is in the example rough machined.

It therefore presents, on much of its transverse surfaces 20 and into the interior of its housing 21, a non-negligible surface grain, of between 1-50 microns, for example, favorable for a good mechanical fixation with the bony ingrowth that should invade it.

In practice this artificial graft 16 is simply pressfit into the envelope 18 that surrounds it.

To facilitate one such engagement, the entirety constituting this envelope 18 and the plate 13 that carries it could be previously heated, and then resulting, by cooling, at least to a certain measure, a friction fit more or less pronounced with the artificial graft 16, favorable to keeping the assembly together.

Nevertheless, such friction fit is not imperative.

Still further, when only a separate single arm 17 is utilized, this arm 17 can be simply closed on itself, without necessarily joining, about the artificial graft 16 that it is to enclose.

The implantation of the vertebral prosthesis 12 according to the invention follows a usual technique.

After having prepared for the implantation of screw 14 in the interested vertebrae 11, and having roughened the adjacent faces of their vertebral levels 10 such as depicted in the features set forth in FIG. 4, in conformity with the height H of the artificial graft 16, the vertebral prosthesis 12 according to the invention is introduced, with the artificial graft 16, between the vertebral levels 10, thus machined until the plate 13 contacts against the surface of the vertebrae, and the screw 14 is then screwed into position.

In the preceding, it was assumed, as indicated, only one level is to be treated.

But, as depicted in the phantom lines in FIG. 4, in the case where two levels simultaneously require one intervention, because two adjacent discs are affected by a pathological injury, or because the entire level or vertebral body including these two discs have to be replaced, as can be seen with cancerous destruction or in serious fractures, the height H of the artificial graft 16 is consequently chosen, and consequently the height of the entire implanted vertebral prosthesis 12, to account for the intermediate vertebral level 10 thus removed.

In an alternate embodiment represented in FIG. 5, the artificial graft 16 maintains a circular exterior shape, but the arm 17 does not have a constant thickness, instead being eccentric in relationship to the outer contour of the arms 17.

In one aspect, and as represented by the features in FIG. 5, the arm 17 is not rejoined to itself, a slot 22 being defined between them in utilization.

But, as depicted in phantom lines, they can also be properly rejoined to each other, as previously discussed.

In a variant embodiment illustrated in FIG. 6, the unit is in the form of a horseshoe, or in a U, analogous to a prior artificial graft.

As depicted in the solid lines, the arms 17 can be separate and does not encircle the artificial graft except on three sides.

But, as previously noted, and as depicted in the phantom lines, this artificial graft can be completely encircled on the totality of its perimeter.

The present invention is not limited to the forms described and the preferred embodiment, but encompasses all variations of execution and/or a combination of its components.

In particular, the arm encircling the implanted artificial graft need not necessarily be one piece with the plate that carries it.

It can also be properly formed with the plate for example by soldering.

Furthermore, instead of the plate being held as described, the ears can be provided with passages for a means of fixation that can permit vertical adjustability of the position of such a plate.

The aperture formed in the ears for the passage of one such means of fixation can, in the place of being circular, as particularly represented, be elongated like into a buttonhole, to permit correspondingly, at least in one certain measure, adjustments in the positon of the entirety.

Accordingly, the housings that form the hollows in the implanted artificial graft don't necessarily need to be in the form of tubes between the transverse surfaces, although this arrangement is preferred, and/or the transverse surfaces need not necessarily be as smooth.

For the treatment of a single level, two half grafts can be implanted back to back,- - -